

(PCT Article 36 and Rule 70)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/JP2005/001389

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following _____, which is the language of a translation furnished for the purposes of:
- ☐ international search (Rule 12.3 and 23.1(b))
- ☐ publication of the international application (Rule 12.4)
- ☐ international preliminary examination (Rule 55.2 and/or 55.3)
2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:
- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1-11 _____ as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☒ the claims:
- nos. _____ as originally filed/furnished
- nos.* _____ as amended (together with any statement) under Article 19
- nos.* 1-14 _____ received by this Authority on 13.07.2005
- nos.* _____ received by this Authority on _____
- ☒ the drawings:
- sheets 1-9 _____ as originally filed/furnished
- sheets* _____ received by this Authority on _____
- sheets* _____ received by this Authority on _____
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages _____
- ☐ the claims, nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to sequence listing (*specify*): _____
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages _____
- ☐ the claims, nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

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Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement		
1. Statement			
Novelty (N)	Claims	1-14	YES
	Claims		NO
Inventive step (IS)	Claims	2, 9	YES
	Claims	1, 3-8, 10-14	NO
Industrial applicability (IA)	Claims	1-14	YES
	Claims		NO
2. Citations and explanations (Rule 70.7)			
<p>Document 1: Microfilm of the specification and drawings annexed to the Japanese Utility Model Application No. 189816/1987 (Laid-open No. 93379/1989) (Misuzu Eric Co., Ltd.), 20 June 1989</p> <p>Document 2: JP 4-183978 A (Seiko Epson Corporation), 30 June 1992</p> <p>Document 3: JP 2003-120541 A (Matsushita Electric Industrial Co., Ltd.), 23 April 2003</p> <p>Document 4: JP 2001-355574 A (Matsushita Electric Industrial Co., Ltd.), 26 December 2001</p> <p>Document 5: JP 9-324764 A (Matsushita Refrigeration Co.), 16 December 1997</p> <p>Document 6: JP 2003-29879 A (Hitachi, Ltd.), 31 January 2003</p> <p>Document 7: JP 2002-163042 A (Toshiba Corporation), 7 June 2002</p> <p>Document 8: JP 2003-121254 A (Yasuhiko Tawara), 23 April 2003</p> <p>The invention set forth in claim 1 does not involve an inventive step in the light of documents 1 and 2 cited in the international search report and newly cited</p>			

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document 8.

In the light of document 1 (description, page 6, lines 6 to 10), the piezoelectric pump driving circuit set forth in document 1 is understood to have a sine wave transmitting means (8) and amplifying means (10, 11).

Although document 1 does not indicate that these amplifying means (10, 11) are driven by a high voltage generated by the voltage boosting means, in driving an amplifying means it is a known technique to drive a circuit with a high voltage generated by a voltage-boosting means which converts a low-voltage power supply into a high voltage, as set forth in document 2 (page 2, lower left column, line 7 to upper right column, line 1).

In addition, in amplifying a signal which drives a piezoelectric element, it is a known technique to use a Class D amplifier and low pass filter, as set forth in document 8 (paragraphs [0024] to [0026]) for example, therefore it would be easy for a person skilled in the art to constitute a signal amplifying means to use a Class D amplifier and a low pass filter.

The inventions set forth in claims 2 and 9 are not disclosed in any of the documents cited in the international search report, and are therefore novel and involve an inventive step. In particular, none of the documents discloses or suggests a controlling means which controls fluctuations in frequency when starting up a sine wave oscillating means using three or more different frequencies.

The invention set forth in claim 3 does not involve an inventive step in the light of documents 1 to 3 cited

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in the international search report and newly cited document 8.

In the light of document 1 (description, page 6, lines 6 to 10), the piezoelectric pump driving circuit is understood to have a sine wave generating means (8) and amplifying means (10, 11).

Although document 1 does not indicate that these amplifying means (10, 11) are driven by a high voltage generated by the voltage boosting means, in driving an amplifying means it is a known technique to drive a circuit with a high voltage generated by a voltage-boosting means which converts a low-voltage power supply into a high voltage, as set forth in document 2 (page 2, lower left column, line 7 to upper right column, line 1).

In addition, in amplifying a signal which drives a piezoelectric element, it is a known technique to use a Class D amplifier and low pass filter, as set forth in document 8 (paragraphs [0024] to [0026]) for example, therefore it would be easy for a person skilled in the art to constitute a signal amplifying means to use a Class D amplifier and a low pass filter.

In addition, discharging foam by controlling fluctuations in frequency is a known technique, as set forth in document 3 (paragraph [0031], for example), and the problem that foam exists at startup is a widely known technical matter in the technical field relating to liquid pumps, therefore it would be easy for a person skilled in the art to constitute an invention so as to vary the frequency when starting up a pump.

The invention set forth in claim 4 does not involve an inventive step in the light of documents 1, 2 and 4

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cited in the international search report.

In the light of document 1 (description, page 6, lines 6 to 10), the piezoelectric pump driving circuit is understood to have a sine wave generating means (8) and amplifying means (10, 11).

Although document 1 does not indicate that these amplifying means (10, 11) are driven by a high voltage generated by the voltage boosting means, in driving an amplifying means it is a known technique to drive a circuit with a high voltage generated by a voltage-boosting means which converts a low-voltage power supply into a high voltage, as set forth in document 2 (page 2, lower left column, line 7 to upper right column, line 1).

In addition, document 4 (paragraph [0031]) indicates that the driving voltage which drives a piezoelectric transducer is varied according to the temperature detected by a temperature sensor (26), therefore it would be easy for a person skilled in the art to provide a controlling means which adjusts the signal amplitude of a sine wave transmitting means according to the temperature detected by a temperature detecting means.

The invention set forth in claim 5 does not involve an inventive step in the light of documents 1, 2 and 4 cited in the international search report and newly cited document 8.

In the light of document 1 (description, page 6, lines 6 to 10), the piezoelectric pump driving circuit set forth in document 1 is understood to have a sine wave transmitting means (8) and amplifying means (10, 11).

Although document 1 does not indicate that these amplifying means (10, 11) are driven by a high voltage

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generated by the voltage boosting means, in driving an amplifying means it is a known technique to drive a circuit with a high voltage generated by a voltage-boosting means which converts a low-voltage power supply into a high voltage, as set forth in document 2 (page 2, lower left column, line 7 to upper right column, line 1).

In addition, in amplifying a signal which drives a piezoelectric element, it is a known technique to use a Class D amplifier and low pass filter, as set forth in document 8 (paragraphs [0024] to [0026]) for example, therefore it would be easy for a person skilled in the art to constitute a signal amplifying means to use a Class D amplifier and a low pass filter.

In addition, document 4 (paragraph [0031]) indicates that the driving voltage which drives a piezoelectric transducer is varied according to the temperature detected by a temperature sensor (26), therefore it would be easy for a person skilled in the art to provide a controlling means which adjusts the signal amplitude of a sine wave transmitting means according to the temperature detected by a temperature detecting means.

The invention set forth in claim 6 does not involve an inventive step in the light of documents 1 to 4 cited in the international search report.

In the light of document 1 (description, page 6, lines 6 to 10), the piezoelectric pump driving circuit set forth in document 1 is understood to have a sine wave transmitting means (8) and amplifying means (10, 11).

Although document 1 does not indicate that these amplifying means (10, 11) are driven by a high voltage generated by the voltage boosting means, in driving an

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amplifying means it is a known technique to drive a circuit with a high voltage generated by a voltage-boosting means which converts a low-voltage power supply into a high voltage, as set forth in document 2 (page 2, lower left column, line 7 to upper right column, line 1).

In addition, discharging foam by controlling fluctuations in frequency is a known technique, as set forth in document 3 (paragraph [0031], for example), and the problem that foam exists at startup is a widely known technical matter in the technical field relating to liquid pumps, therefore it would be easy for a person skilled in the art to constitute an invention so as to vary the frequency when starting up a pump.

In addition, document 4 (paragraph [0031]) indicates that the driving voltage which drives a piezoelectric transducer is varied according to the temperature detected by a temperature sensor (26), therefore it would be easy for a person skilled in the art to provide a controlling means which adjusts the signal amplitude of a sine wave transmitting means according to the temperature detected by a temperature detecting means.

The invention set forth in claim 7 does not involve an inventive step in the light of documents 1 to 4 cited in the international search report and newly cited document 8.

In the light of document 1 (description, page 6, lines 6 to 10), the piezoelectric pump driving circuit set forth in document 1 is understood to have a sine wave transmitting means (8) and amplifying means (10, 11).

Although document 1 does not indicate that these amplifying means (10, 11) are driven by a high voltage

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generated by the voltage boosting means, in driving an amplifying means it is a known technique to drive a circuit with a high voltage generated by a voltage-boosting means which converts a low-voltage power supply into a high voltage, as set forth in document 2 (page 2, lower left column, line 7 to upper right column, line 1).

In addition, in amplifying a signal which drives a piezoelectric element, it is a known technique to use a Class D amplifier and low pass filter, as set forth in document 8 (paragraphs [0024] to [0026]) for example, therefore it would be easy for a person skilled in the art to constitute a signal amplifying means to use a Class D amplifier and a low pass filter.

In addition, discharging foam by controlling fluctuations in frequency is a known technique, as set forth in document 3 (paragraph [0031], for example), and the problem that foam exists at startup is a widely known technical matter in the technical field relating to liquid pumps, therefore it would be easy for a person skilled in the art to constitute an invention so as to vary the frequency when starting up a pump.

In addition, document 4 (paragraph [0031]) indicates that the driving voltage which drives a piezoelectric transducer is varied according to the temperature detected by a temperature sensor (26), therefore it would be easy for a person skilled in the art to provide a controlling means which adjusts the signal amplitude of a sine wave transmitting means according to the temperature detected by a temperature detecting means.

The invention set forth in claim 8 does not involve an inventive step in the light of documents 1, 2 and 4

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cited in the international search report, and newly cited document 8.

In the light of document 1 (description, page 6, lines 6 to 10), the piezoelectric pump driving circuit set forth in document 1 is understood to have a sine wave transmitting means (8) and amplifying means (10, 11).

Although document 1 does not indicate that these amplifying means (10, 11) are driven by a high voltage generated by the voltage boosting means, in driving an amplifying means it is a known technique to drive a circuit with a high voltage generated by a voltage-boosting means which converts a low-voltage power supply into a high voltage, as set forth in document 2 (page 2, lower left column, line 7 to upper right column, line 1).

In addition, in amplifying a signal which drives a piezoelectric element, it is a known technique to use a Class D amplifier and low pass filter, as set forth in document 8 (paragraphs [0024] to [0026]) for example, therefore it would be easy for a person skilled in the art to constitute a signal amplifying means to use a Class D amplifier and a low pass filter.

Moreover, a cooling system having a heat sink, a radiator and a piezoelectric pump is known, as set forth in document 4.

The invention set forth in claim 10 does not involve an inventive step in the light of documents 1 to 4 cited in the international search report and newly cited document 8.

In the light of document 1 (description, page 6, lines 6 to 10), the piezoelectric pump driving circuit set forth in document 1 is understood to have a sine wave

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	<p>transmitting means (8) and amplifying means (10, 11).</p> <p>Although document 1 does not indicate that these amplifying means (10, 11) are driven by a high voltage generated by the voltage boosting means, in driving an amplifying means it is a known technique to drive a circuit with a high voltage generated by a voltage-boosting means which converts a low-voltage power supply into a high voltage, as set forth in document 2 (page 2, lower left column, line 7 to upper right column, line 1).</p> <p>In addition, in amplifying a signal which drives a piezoelectric element, it is a known technique to use a Class D amplifier and low pass filter, as set forth in document 8 (paragraphs [0024] to [0026]) for example, therefore it would be easy for a person skilled in the art to constitute a signal amplifying means to use a Class D amplifier and a low pass filter.</p> <p>In addition, discharging foam by controlling fluctuations in frequency is a known technique, as set forth in document 3 (paragraph [0031], for example), and the problem that foam exists at startup is a widely known technical matter in the technical field relating to liquid pumps, therefore it would be easy for a person skilled in the art to constitute an invention so as to vary the frequency when starting up a pump.</p> <p>Moreover, a cooling system having a heat sink, a radiator and a piezoelectric pump is known, as set forth in document 4.</p> <p>The invention set forth in claim 11 does not involve an inventive step in the light of documents 1, 2 and 4 cited in the international search report.</p> <p>In the light of document 1 (description, page 6,</p>

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lines 6 to 10), the piezoelectric pump driving circuit set forth in document 1 is understood to have a sine wave transmitting means (8) and amplifying means (10, 11).

Although document 1 does not indicate that these amplifying means (10, 11) are driven by a high voltage generated by the voltage boosting means, in driving an amplifying means it is a known technique to drive a circuit with a high voltage generated by a voltage-boosting means which converts a low-voltage power supply into a high voltage, as set forth in document 2 (page 2, lower left column, line 7 to upper right column, line 1).

In addition, document 4 (paragraph [0031]) indicates that the driving voltage which drives a piezoelectric transducer is varied according to the temperature detected by a temperature sensor (26), therefore it would be easy for a person skilled in the art to provide a controlling means which adjusts the signal amplitude of a sine wave transmitting means according to the temperature detected by a temperature detecting means.

Moreover, a cooling system having a heat sink, a radiator and a piezoelectric pump is known, as set forth in document 4.

The invention set forth in claim 12 does not involve an inventive step in the light of documents 1, 2 and 4 cited in the international search report and newly cited document 8.

In the light of document 1 (description, page 6, lines 6 to 10), the piezoelectric pump driving circuit set forth in document 1 is understood to have a sine wave transmitting means (8) and amplifying means (10, 11).

Although document 1 does not indicate that these

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amplifying means (10, 11) are driven by a high voltage generated by the voltage boosting means, in driving an amplifying means it is a known technique to drive a circuit with a high voltage generated by a voltage-boosting means which converts a low-voltage power supply into a high voltage, as set forth in document 2 (page 2, lower left column, line 7 to upper right column, line 1).

In addition, in amplifying a signal which drives a piezoelectric element, it is a known technique to use a Class D amplifier and low pass filter, as set forth in document 8 (paragraphs [0024] to [0026]) for example, therefore it would be easy for a person skilled in the art to constitute a signal amplifying means to use a Class D amplifier and a low pass filter.

In addition, document 4 (paragraph [0031]) indicates that the driving voltage which drives a piezoelectric transducer is varied according to the temperature detected by a temperature sensor (26), therefore it would be easy for a person skilled in the art to provide a controlling means which adjusts the signal amplitude of a sine wave transmitting means according to the temperature detected by a temperature detecting means.

Moreover, a cooling system having a heat sink, a radiator and a piezoelectric pump is known, as set forth in document 4.

The invention set forth in claim 13 does not involve an inventive step in the light of documents 1 to 4 cited in the international search report.

In the light of document 1 (description, page 6, lines 6 to 10), the piezoelectric pump driving circuit set forth in document 1 is understood to have a sine wave

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transmitting means (8) and amplifying means (10, 11).

Although document 1 does not indicate that these amplifying means (10, 11) are driven by a high voltage generated by the voltage boosting means, in driving an amplifying means it is a known technique to drive a circuit with a high voltage generated by a voltage-boosting means which converts a low-voltage power supply into a high voltage, as set forth in document 2 (page 2, lower left column, line 7 to upper right column, line 1).

In addition, discharging foam by controlling fluctuations in frequency is a known technique, as set forth in document 3 (paragraph [0031], for example), and the problem that foam exists at startup is a widely known technical matter in the technical field relating to liquid pumps, therefore it would be easy for a person skilled in the art to constitute an invention so as to vary the frequency when starting up a pump.

In addition, document 4 (paragraph [0031]) indicates that the driving voltage which drives a piezoelectric transducer is varied according to the temperature detected by a temperature sensor (26), therefore it would be easy for a person skilled in the art to provide a controlling means which adjusts the signal amplitude of a sine wave transmitting means according to the temperature detected by a temperature detecting means.

Moreover, a cooling system having a heat sink, a radiator and a piezoelectric pump is known, as set forth in document 4.

The invention set forth in claim 14 does not involve an inventive step in the light of documents 1 to 4 cited in the international search report and newly cited

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In the light of document 1 (description, page 6, lines 6 to 10), the piezoelectric pump driving circuit set forth in document 1 is understood to have a sine wave transmitting means (8) and amplifying means (10, 11).

Although document 1 does not indicate that these amplifying means (10, 11) are driven by a high voltage generated by the voltage boosting means, in driving an amplifying means it is a known technique to drive a circuit with a high voltage generated by a voltage-boosting means which converts a low-voltage power supply into a high voltage, as set forth in document 2 (page 2, lower left column, line 7 to upper right column, line 1).

In addition, in amplifying a signal which drives a piezoelectric element, it is a known technique to use a Class D amplifier and low pass filter, as set forth in document 8 (paragraphs [0024] to [0026]) for example, therefore it would be easy for a person skilled in the art to constitute a signal amplifying means to use a Class D amplifier and a low pass filter.

In addition, discharging foam by controlling fluctuations in frequency is a known technique, as set forth in document 3 (paragraph [0031], for example), and the problem that foam exists at startup is a widely known technical matter in the technical field relating to liquid pumps, therefore it would be easy for a person skilled in the art to constitute an invention so as to vary the frequency when starting up a pump.

In addition, document 4 (paragraph [0031]) indicates that the driving voltage which drives a piezoelectric transducer is varied according to the temperature detected by a temperature sensor (26), therefore it would

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be easy for a person skilled in the art to provide a controlling means which adjusts the signal amplitude of a sine wave transmitting means according to the temperature detected by a temperature detecting means.

Moreover, a cooling system having a heat sink, a radiator and a piezoelectric pump is known, as set forth in document 4.

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

- (1) The "fig. 6" set forth in paragraph [0042] is understood to be a typographical error for "fig. 5".
- (2) The "fig. 1" set forth in paragraphs [0049] and [0050] is understood to be a typographical error for "fig. 7".